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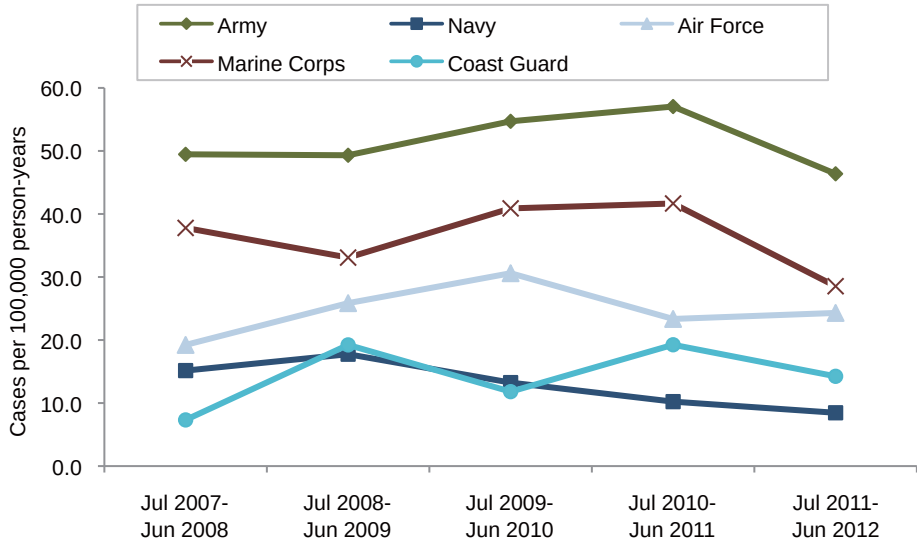
Update: Cold Weather Injuries, Active and Reserve Components, U.S. Armed Forces, July 2007-June 2012

From July 2011 through June 2012, the number of active and reserve component service members treated for cold injuries (n=499) was lower than the number in each of the four previous one year periods. Over the last five years, frostbite was the most common type of cold injury in all the Services except for the Marine Corps, in which hypothermia was slightly more frequent. Service members who were female, less than 20 years old, or of black, non-Hispanic race/ethnicity tended to have higher cold injury rates than their respective counterparts. Army personnel accounted for the majority of cold injuries. Service members who train in and deploy to areas with wet and freezing conditions – and their supervisors at all levels – should be able to recognize the signs of cold injury and should know and implement the standard countermeasures against the threat of cold injury.

Prolonged and/or intense exposures to cold can significantly impact the health, well-being and operational effectiveness of service members and their units.[1-5] Because U.S. military operations are conducted in diverse geographic and weather conditions, the U.S. military has developed extensive countermeasures against threats associated with training and operating in cold environments.[1-6]

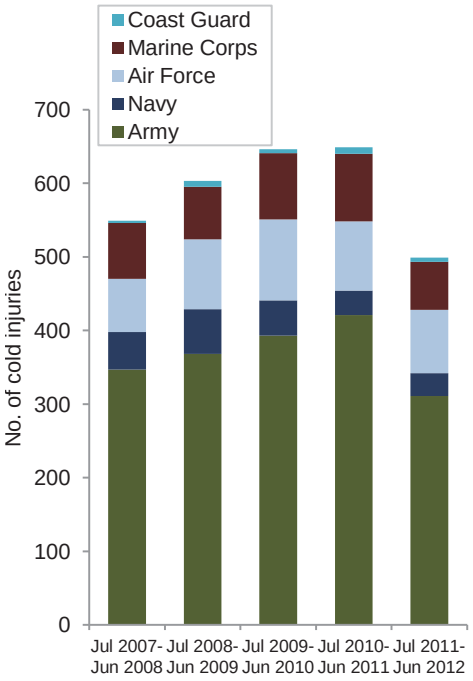
In recent years, rates of hospitalization for cold weather injuries of U.S. military members have generally declined, at least in part, because of improvements in clothing, equipment, policies, and practices.[2] Still, cold injuries (many of them preventable) affect hundreds of service members each year. This report summarizes frequencies, rates, and correlates of risk of cold injuries among members of active and reserve components of the U.S. Armed Forces during the past five years.

FIGURE 1. Rates of cold injury[a] by service and cold year, active component, U.S. Armed Forces, July 2007-June 2012



[a]One cold injury per individual per year

FIGURE 2. Cold injuries[a] by cold year and service, active and reserve components, U.S. Armed Forces, July 2007-June 2012



[a]One cold injury per individual per year

METHODS

The surveillance period was 1 July 2007 to 30 June 2012. The surveillance population included all individuals who served in an active and/or reserve component of the U.S. Armed Forces at any time during the surveillance period. For analysis purposes, "cold years" were defined by 1 July through 30 June intervals so that complete cold weather seasons could be represented in year-to-year summaries and comparisons.

The Defense Medical Surveillance System (DMSS) maintains electronic records of all actively serving U.S. military members' hospitalizations and ambulatory visits in U.S. military and civilian (contracted/purchased care through the Military Health System) medical facilities worldwide; the DMSS also maintains records of medical encounters of service members deployed to southwest Asia/Middle East that are captured in the Theater Medical Data Store

TABLE 1A. Cold injuries, active component, U.S. Army, July 2007-June 2012

	Frostbite		Immersion foot		Hypothermia		Unspecified		All cold injuries[b]	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	742	27.1	171	6.3	168	6.1	409	14.9	1,490	54.5
Sex										
Male	590	24.9	155	6.6	148	6.3	265	11.2	1,158	48.9
Female	152	41.1	16	4.3	20	5.4	144	38.9	332	89.8
Race/ethnicity										
White, non-Hispanic	333	19.6	111	6.5	107	6.3	173	10.2	724	42.7
Black, non-Hispanic	301	55.6	39	7.2	35	6.5	181	33.4	556	102.7
Other	108	21.7	21	4.2	26	5.2	55	11.0	210	42.1
Age group										
<20	73	47.4	16	10.4	25	16.2	53	34.4	167	108.3
20-24	284	33.8	77	9.2	85	10.1	150	17.8	596	70.8
25-29	179	26.4	35	5.2	29	4.3	93	13.7	336	49.6
30-34	80	19.0	24	5.7	16	3.8	49	11.6	169	40.2
35-39	60	17.9	13	3.9	4	1.2	35	10.4	112	33.4
40-44	42	20.8	4	2.0	6	3.0	20	9.9	72	35.7
45+	24	22.9	2	1.9	3	2.9	9	8.6	38	36.3
Rank										
Enlisted	680	29.9	157	6.9	158	6.9	371	16.3	1,366	60.0
Officer	62	13.5	14	3.0	10	2.2	38	8.3	124	27.0
Occupation										
Infantry/artillery/ combat engineering	248	38.3	68	10.5	67	10.3	76	11.7	459	70.9
Armor/motor transport	28	18.8	7	4.7	8	5.4	21	14.1	64	42.9
Repair/engineering	116	20.5	36	6.4	36	6.4	78	13.8	266	46.9
Comm/intel	184	28.2	33	5.1	23	3.5	117	18.0	357	54.8
Health care	56	21.6	3	1.2	10	3.9	45	17.3	114	43.9
Other	110	23.8	24	5.2	24	5.2	72	15.6	230	49.9
Cold year (Jul-Jun)										
2007-2008	132	25.4	34	6.5	31	6.0	74	14.2	271	52.2
2008-2009	139	25.7	38	7.0	27	5.0	78	14.4	282	52.1
2009-2010	150	27.2	44	8.0	37	6.7	95	17.2	326	59.1
2010-2011	176	31.2	31	5.5	43	7.6	88	15.6	338	59.9
2011-2012	145	26.0	24	4.3	30	5.4	74	13.2	273	48.9

[a]Rate per 100,000 person-years
[b]One of each type of cold injury per individual per year

(TMDS). Because cold weather injuries represent a threat to the health of individual service members and to military training and operations, the Armed Forces require that such injuries be expeditiously reported as reportable medical events through one of the service specific electronic reporting systems; these reports are routinely transmitted and incorporated into the DMSS. For this analysis inpatient, outpatient, and reportable medical event records in the DMSS were searched to identify all primary (first-listed) diagnoses of "frostbite" (ICD-9-CM codes: 991.0-991.3), "immersion foot" (ICD-9-CM: 991.4), "hypothermia" (ICD-9-CM: 991.6), and "other specified/ unspecified effects of reduced temperature" (ICD-9-CM: 991.8-991.9). To exclude follow-up encounters for single cold injury episodes, only one cold injury per individual per cold season was included. In summaries by type of cold injury, one of each type of cold injury per individual per cold season was included. If multiple medical encounters for cold injuries occurred on the same day, only one was used for analysis (hospitalizations were prioritized over ambulatory visits).

Annual rates of cold injuries (per 100,000 person-years [p-yrs] of service) were estimated only for the active component because the start and end dates of all active duty service periods of reserve component members were not available.

RESULTS

2011-2012

From July 2011 through June 2012, 499 members of the active and reserve components had at least one medical encounter with a primary diagnosis of cold injury. During the year, 14 percent (n=70) of those affected by cold injury were members of the reserve component. The number of reserve component members affected by cold injuries was lower in 2011-12 than in any of the previous four years (mean = 115.5 per year) **(data not shown)**.

During the year, 429 members of the active component (rate: 30.5 per 100,000 p-yrs) had at least one medical encounter for cold injury; in general, the cold injury encounter rates among active component members (overall rate: 34.5 per 100,000 p-yrs) have been remarkably stable over the past five years **(data not shown)**.

During the 2011-12 cold season, in the active component, the rate of any recorded cold injury in the Army (46.4 per 100,000 p-yrs) was 63 percent higher than in the Marine Corps (28.5 per 100,000 p-yrs), 91 percent higher than in the Air Force (24.3 per 100,000 p-yrs), 227 percent higher than in the Coast Guard (14.2 per 100,000 p-yrs), and approximately four and a half times higher than in the Navy (8.5 per 100,000 p-yrs) **(Figure 1)**. In the past year, soldiers accounted for 60 percent of all active component members affected by cold injuries **(Figure 2)**.

During the past cold season, frostbite was the most common type of cold injury in each service except the Marine Corps, in which hypothermia affected more service members **(Tables 1a-d)**. In the Army and Navy, the overall rates of cold injuries (any type) in 2011-12 were lower than those of the previous four years; the decline was reflected in each type of cold injury **(Tables 1a, 1b)**. In the Air Force, the rate of cold injuries (any type) in 2011-12 was similar to that of the previous year **(Table 1c)**. In the Marine Corps, the rate of cold injuries in 2011-12 decreased by about a third compared to the previous two years. The overall decrease was attributable to a more than 65 percent decrease in frostbite cases and slight decreases in immersion foot and

TABLE 1B. Cold injuries, active component, U.S. Navy, July 2007-June 2012

	Frostbite		Immersion foot		Hypothermia		Unspecified		All cold injuries[b]	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	84	5.2	58	3.6	43	2.6	29	1.8	214	13.2
Sex										
Male	65	4.7	53	3.9	37	2.7	24	1.8	179	13.1
Female	19	7.5	5	2.0	6	2.4	5	2.0	35	13.9
Race/ethnicity										
White, non-Hispanic	47	5.5	36	4.2	23	2.7	13	1.5	119	13.8
Black, non-Hispanic	20	7.6	2	0.8	7	2.7	10	3.8	39	14.8
Other	17	3.4	20	4.0	13	2.6	6	1.2	56	11.3
Age group										
<20	13	14.9	17	19.5	6	6.9	2	2.3	38	43.7
20-24	32	6.1	24	4.6	24	4.6	14	2.7	94	18.0
25-29	19	4.9	9	2.3	10	2.6	4	1.0	42	10.8
30-34	5	2.0	6	2.4	2	0.8	4	1.6	17	6.9
35-39	6	2.9	1	0.5	0	0.0	2	1.0	9	4.4
40-44	6	5.4	1	0.9	0	0.0	2	1.8	9	8.1
45+	3	4.7	0	0.0	1	1.6	1	1.6	5	7.8
Rank										
Enlisted	72	5.3	54	4.0	40	2.9	25	1.8	191	14.0
Officer	12	4.6	4	1.5	3	1.1	4	1.5	23	8.8
Occupation										
Infantry/artillery/ combat engineering	4	3.5	4	3.5	6	5.2	2	1.7	16	14.0
Armor/motor transport	4	6.9	6	10.4	3	5.2	3	5.2	16	27.7
Repair/engineering	21	3.2	23	3.5	19	2.9	11	1.7	74	11.2
Comm/intel	8	2.7	4	1.4	4	1.4	3	1.0	19	6.5
Health care	9	5.3	2	1.2	2	1.2	3	1.8	16	9.4
Other	38	11.7	19	5.8	9	2.8	7	2.1	73	22.4
Cold year (Jul-Jun)										
2007-2008	23	7.0	14	4.2	4	1.2	9	2.7	50	15.2
2008-2009	26	8.0	17	5.2	11	3.4	5	1.5	59	18.1
2009-2010	11	3.4	13	4.0	12	3.7	8	2.5	44	13.6
2010-2011	14	4.3	6	1.9	11	3.4	3	0.9	34	10.5
2011-2012	10	3.1	8	2.5	5	1.6	4	1.3	27	8.5

[a]Rate per 100,000 person-years
[b]One of each type of cold injury per individual per year

hypothermia cases **(Table 1d)**. There were only six cold injuries (rate: 14.2 per 100,000 p-yrs) in the Coast Guard in 2011-12 and a total of 32 cases (rate: 15.3 per 100,000 p-yrs) over the entire five-year period **(Coast Guard data not shown)**.

2007-2012

In general, rates of frostbite and "unspecified" cold injuries – and cold injuries overall – were higher among females than males during the five-year surveillance period **(Tables 1a-d)**. In contrast, rates of immersion foot and hypothermia were generally higher among males **(Tables 1a-d)**.

In every service, rates of frostbite and hypothermia – and cold injuries overall – were consistently higher among black, non-Hispanics than among other racial-ethnic group members; in particular, in the Army and Marine Corps, rates of cold injuries overall were more than twice as high in black, non-Hispanic service members **(Tables 1a-d)**. Furthermore, in every military occupational category except recruits and trainees, black, non-Hispanic service members had at least twice the rate of cold injuries as other racial-ethnic group members **(data not shown)**.

In general, rates of cold injuries were higher among the youngest aged (<20 years old) and enlisted members relative to their respective counterparts. However, in the Marine Corps, rates of frostbite were slightly higher among 30- to 34-year-olds than those less than 20 years old and rates of frostbite, unspecified cold injuries, and all cold injuries were higher among officers than enlisted members **(Tables 1a-d)**.

In the Army and Air Force, rates were highest among service members in infantry/artillery/combat engineering-related occupations **(Tables 1a, 1c)**. A majority of this occupational category was comprised of "general infantry" in the Army and "military training instructors" in the Air Force **(data not shown)**. In the Navy, the highest rate was in armor/motor transport-related occupations **(Table 1b)**; this category was comprised of two Navy occupations – "general seamanship" and "boatswains" **(data not shown)**. In the Marine Corps, service members in the "other" occupational category had the highest rate of cold injuries **(Table 1d)**; the group that contributed a majority of these cases was comprised of Marines who were "not occupationally qualified" (i.e., individuals in training status) **(data not shown)**.

During the five-year surveillance period, there were 2,414 active component service members affected by any cold injury. Of these, 59 (2.4%) were recruits/basic trainees. Marine Corps recruits accounted for relatively more of the total cold injuries of their service (5.5% of all cold injuries during the period) than did recruits of the other services (Army, 2.3%; Navy, 1.4%; Air Force, 0.7%) **(data not shown)**. Also during the period, 59 (2.4%) of the 2,414 service members affected with cold injuries were hospitalized. Most (81%) of the hospitalized cases affected Army (n=38) or Marine Corps (n=10) members **(data not shown)**.

Cold injuries in Iraq and Afghanistan

During the five-year surveillance period, 297 cold injuries occurred and were treated in a major theater of operation (i.e., Iraq, Afghanistan) **(data not shown)**. Of these, nearly half (n=146; 49.2%) were frostbite, 73 (24.6%) were immersion foot, 35 (11.8%) were hypothermia, and 43 (14.5%) were unspecified cold injuries. Cold injuries in deployed service members most often affected those who were male (n=262; 88.2%), white, non-Hispanic (n=182; 61.3%), aged 20-24 (n=146; 49.2%), in the Army (n=220; 74.1%), enlisted grade (n=277; 93.3%), and in infantry/artillery/combat engineering occupations (n=118;

TABLE 1C. Cold injuries, active component, U.S. Air Force, July 2007-June 2012

	Frostbite		Immersion foot		Hypothermia		Unspecified		All cold injuries[b]	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	215	13.1	62	3.8	59	3.6	74	4.5	410	25.0
Sex										
Male	176	13.3	53	4.0	51	3.9	49	3.7	329	24.8
Female	39	12.3	9	2.8	8	2.5	25	7.9	81	25.5
Race/ethnicity										
White, non-Hispanic	129	11.1	52	4.5	41	3.5	47	4.1	269	23.2
Black, non-Hispanic	48	20.6	6	2.6	13	5.6	21	9.0	88	37.8
Other	38	15.2	4	1.6	5	2.0	6	2.4	53	21.1
Age group										
<20	23	31.2	8	10.8	4	5.4	10	13.5	45	61.0
20-24	108	23.1	32	6.8	26	5.6	32	6.8	198	42.3
25-29	44	10.7	9	2.2	14	3.4	13	3.2	80	19.5
30-34	17	6.4	3	1.1	4	1.5	9	3.4	33	12.3
35-39	12	5.5	4	1.8	6	2.8	4	1.8	26	12.0
40-44	9	6.4	6	4.3	2	1.4	4	2.9	21	15.0
45+	2	3.1	0	0.0	3	4.7	2	3.1	7	10.9
Rank										
Enlisted	188	14.3	59	4.5	51	3.9	67	5.1	365	27.8
Officer	27	8.3	3	0.9	8	2.4	7	2.1	45	13.8
Occupation										
Infantry/artillery/ combat engineering	4	40.7	3	30.5	0	0.0	1	10.2	8	81.5
Repair/engineering	80	15.1	22	4.1	17	3.2	18	3.4	137	25.8
Comm/intel	41	10.5	6	1.5	14	3.6	15	3.8	76	19.4
Health care	10	6.4	1	0.6	4	2.5	5	3.2	20	12.7
Other	80	14.8	30	5.6	23	4.3	35	6.5	168	31.1
Cold year (Jul-Jun)										
2007-2008	39	11.9	6	1.8	9	2.7	10	3.1	64	19.5
2008-2009	35	10.8	17	5.2	14	4.3	19	5.8	85	26.2
2009-2010	48	14.5	17	5.2	12	3.6	24	7.3	101	30.6
2010-2011	47	14.2	12	3.6	10	3.0	10	3.0	79	24.0
2011-2012	46	14.0	10	3.0	14	4.3	11	3.3	81	24.6

[a]Rate per 100,000 person-years
[b]One of each type of cold injury per individual per year

39.7%). Reports of cold injuries during deployment have increased during the period; nearly two-thirds of those reported occurred in 2010-11 (n=76; 25.6%) and 2011-12 (n=117; 39.4%) **(data not shown)**.

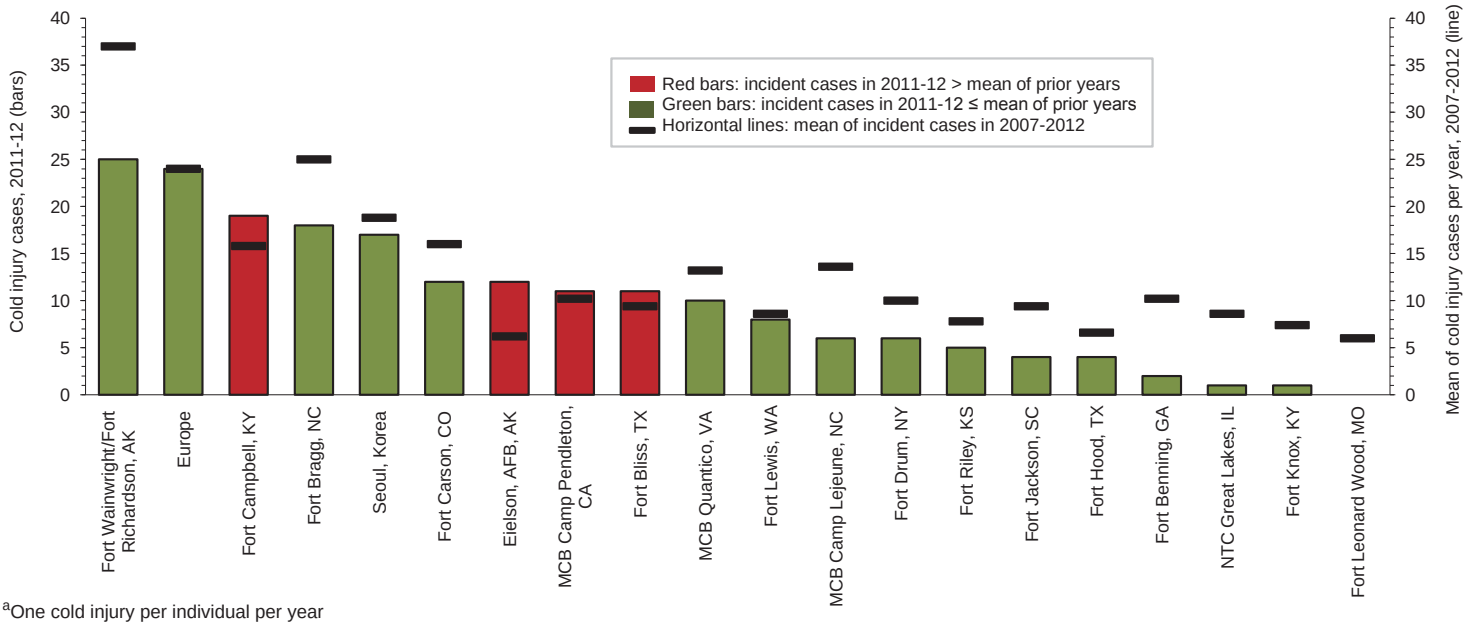
Cold injuries by location

There were 20 locations worldwide that reported 30 or more cold injuries. Of these locations, four had more (and 16 had fewer) cold injuries in 2011-12 than the average of cold injury episodes per year during the prior four years at the respective locations **(Figure 3)**. In the past year, two locations Forts Wainwright and Richardson in Alaska (n=25), and Europe (n=24) had more than 20 cold injury cases each among active and reserve component members **(Figure 3)**.

EDITORIAL COMMENT

During the past cold season, numbers and rates of the different types of cold injuries among U.S. service members were lower than those in recent prior years. This observation may be a consequence of the relatively mild winter of 2011-12 throughout the United States. As in the past, rates of cold injuries overall remain higher in the Army and Marine Corps than in the Air Force, Navy, and Coast Guard. In the

FIGURE 3. Annual number of cold injuries,[a] 2011-12 and mean during 2007-12, at locations with at least 30 cold injuries during the surveillance period, active and reserve component members, U.S. Armed Forces, July 2007-June 2012



[a]One cold injury per individual per year

TABLE 1D. Cold injuries, active component, U.S. Marine Corps, July 2007-June 2012

	Frostbite		Immersion foot		Hypothermia		Unspecified		All cold injuries[b]	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	100	10.1	99	10.0	125	12.6	44	4.4	368	37.1
Sex										
Male	86	9.3	97	10.5	116	12.5	41	4.4	340	36.7
Female	14	21.7	2	3.1	9	13.9	3	4.6	28	43.3
Race/ethnicity										
White, non-Hispanic	52	7.8	72	10.8	68	10.2	29	4.3	221	33.0
Black, non-Hispanic	31	31.7	8	8.2	23	23.5	8	8.2	70	71.6
Other	17	7.6	19	8.5	34	15.2	7	3.1	77	34.3
Age group										
<20	18	14.7	37	30.3	41	33.5	10	8.2	106	86.7
20-24	46	9.8	52	11.1	62	13.2	21	4.5	181	38.5
25-29	19	9.6	8	4.0	14	7.1	8	4.0	49	24.8
30-34	14	14.9	2	2.1	5	5.3	5	5.3	26	27.8
35-39	2	3.1	0	0.0	0	0.0	0	0.0	2	3.1
40-44	0	0.0	0	0.0	3	10.0	0	0.0	3	10.0
45+	1	7.9	0	0.0	0	0.0	0	0.0	1	7.9
Rank										
Enlisted	80	9.0	90	10.2	117	13.2	35	3.9	322	36.3
Officer	20	19.0	9	8.6	8	7.6	9	8.6	46	43.7
Occupation										
Infantry/artillery/ combat engineering	26	11.6	15	6.7	28	12.5	8	3.6	77	34.4
Armor/motor transport	2	3.6	2	3.6	1	1.8	2	3.6	7	12.5
Repair/engineering	6	2.6	7	3.0	5	2.1	4	1.7	22	9.4
Comm/intel	19	8.8	4	1.8	11	5.1	10	4.6	44	20.3
Other	47	18.0	71	27.1	80	30.6	20	7.6	218	83.3
Cold year (Jul-Jun)										
2007-2008	19	10.1	22	11.7	21	11.2	11	5.9	73	38.9
2008-2009	18	9.0	21	10.5	21	10.5	7	3.5	67	33.6
2009-2010	28	13.8	14	6.9	34	16.7	10	4.9	86	42.4
2010-2011	26	12.9	24	11.9	28	13.9	7	3.5	85	42.2
2011-2012	9	4.5	18	9.0	21	10.5	9	4.5	57	28.5

[a]Rate per 100,000 person-years
[b]One of each type of cold injury per individual per year

Army, Marine Corps, and Navy the rates of cold injuries during the past cold season were the lowest of the last five cold seasons. Compared to the prior seasons, in 2011-12, rates were similar in the Air Force, and declined slightly in the Coast Guard.

Comparisons of cold injury experiences among the Services should be done carefully if at all. For example, differences across services in cold injury rates – overall, by type, and in relation to the military characteristics of those most affected – reflect differences in the natures, locations, and circumstances of the training and operations of the Services. Also, differences in rates across services may reflect differences in the ascertainment and/or reporting of cold injury cases (e.g., records of medical encounters during field exercises, and aboard Navy ships are not routinely available for health surveillance purposes).

Among service members overall, the youngest, female, enlisted, and black, non-Hispanic service members have relatively high rates of cold injuries – particularly frostbite – compared to their respective counterparts. Furthermore, rates of cold injuries are highest in black, non-Hispanics in all enlisted and officer occupations, suggesting that other factors (e.g., physiologic differences, previous cold weather experience) play a role beyond observed differences in occupational exposure. Other reports have documented that African American soldiers and soldiers with prior cold injuries have increased susceptibilities to cold injuries during prolonged or intense cold exposures.[2,3] Special vigilance by individuals, line supervisors, commanders, and medical staff is indicated to prevent cold injuries among those with known or suspected increased susceptibilities.

The number of cold injuries recorded in association with deployment to Iraq and Afghanistan has increased each cold year since 2008-09 with the highest number occurring in the most recent cold year. This trend likely reflects several factors, such as increased numbers of service members exposed to cold because of changes in operational tempo or changes in year-to-year weather patterns, or improved surveillance and reporting of cold injuries.

Commanders and supervisors at all levels should implement appropriate countermeasures to prevent cold injuries, including the proper use of protective clothing and equipment, wind chill temperature monitoring and awareness training.[1,4] Service members who train in and deploy to areas with wet and freezing conditions should know the signs of cold injury and how to protect themselves against such injuries through use of the standard countermeasures, adequate hydration, and avoidance of tobacco, caffeine, and vasoconstrictive medications.[1,4,6] Up-to-date cold injury prevention materials (including posters, presentation outlines, policies, regulations, and technical bulletins) are available online: http://phc.amedd.army.mil/topics/discond/cip/Pages/default.aspx.

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Thyroid Disorders among Active Component Military Members, U.S. Armed Forces, 2002-2011

During 2002-2011, among active component U.S. military members, the rates of idiopathic hypothyroidism were 39.7 and 7.8 per 10,000 person-years among females and males, respectively. Unadjusted rates of idiopathic hypothyroidism and chronic thyroiditis (e.g., Hashimoto's disease) were at least twice as high among white, non-Hispanic as black, non-Hispanic service members. However, black, non-Hispanic service members had higher rates of goiter and thyrotoxicosis. Increasing rates of thyroid disorders during the period were accompanied by increases in numbers of screening tests for thyroid function recorded during outpatient visits. Increased thyroid function testing since the beginning of the wars in Iraq and Afghanistan may reflect increased testing of military members with mental disorders (e.g., depression, irritability, PTSD), musculoskeletal pain, sleep disorders, menstrual/fertility abnormalities, obesity, and other conditions which have sharply increased in prevalence over the same period.

At the direction of the pituitary gland (through thyroid stimulating hormone [TSH]), the thyroid gland produces hormones that regulate the body's metabolism. Overstimulation or over-activity of the thyroid causes excessive secretion of thyroid hormones resulting in "hyperthyroidism"; its clinical manifestation include rapid or irregular heartbeat, heat intolerance, sweating, tremor of hands and fingers, decreased strength and endurance, weight loss despite increased appetite and caloric intake, abnormal menstruation, and in some cases, exophthalmos ("bulging eyes") and enlarged thyroid gland ("goiter"). "Thyroid storm" is a life threatening clinical expression of severe hyperthyroidism.

Under-stimulation or under-activity of the thyroid gland results in insufficient secretion of thyroid hormones, eventually producing "hypothyroidism"; its clinical manifestations include weight gain, lethargy, muscle and joint pains, dry skin, constipation, decreased strength and endurance, cold intolerance, abnormal menstruation and infertility. Both hyperthyroidism and hypothyroidism are associated with neuropsychological disorders (including depression, abnormal reflexes, sleep disorders)[1] and other endocrine disorders (notably, type I diabetes).

Goiter may be symmetrical and diffuse or may be asymmetrical or focal. There are numerous possible causes of goiter which may be accompanied by normal thyroid function or either hypo- or hyperthyroidism.

In the United States, as in most developed countries, most thyroid dysfunction is due to autoimmune disease of unknown etiology and the most common thyroid disorders are primary hypothyroidism (most often due to Hashimoto's thyroiditis) and Graves' disease (which causes hyperthyroidism). Secondary hypothyroidism may result from hypothalamic or pituitary dysfunction or from treatment of hyperthyroidism or thyroid cancer by surgery or radioiodine therapy ("post-therapeutic hypothyroidism").

As with other autoimmune diseases, rates of thyroid disorders are higher among women than men and increase with age. In 2008 in the United States, approximately 3.5 percent of women 18-44 and 13.3 percent of women 45-64 years old were treated for thyroid disorders.[2] Thyroid disorders are a frequent cause of medical visits in the U.S. military. In 2011, thyroid disorders affected at least 12,789 active component members and were the principal reasons for 27,103 medical visits and 522 hospital bed days.[3,4]

Both hyperthyroidism and hypothyroidism can significantly degrade the military operational capabilities of affected military members.[5] Screening of healthy populations for thyroid disorders is not recommended; however, thyroid function testing is often done to rule out thyroid dysfunction as a cause of or exacerbating factor for other conditions. Of note in this regard, many signs and symptoms of thyroid dysfunction overlap with the clinical manifestations of other conditions of military importance (e.g., musculoskeletal and sleep disorders, obesity, depression, PTSD).[6] This report summarizes the incidence and trends of thyroid disorders other than thyroid cancer among active component members of the U.S. military.

METHODS

The surveillance period was 1 January 2002 through 31 December 2011. Thyroid disorders were identified by diagnostic codes for "disorders of thyroid gland" (ICD-9-CM: 240-246) recorded in standardized records of inpatient and outpatient encounters in military and nonmilitary medical facilities documented in the Defense Medical Surveillance System (DMSS). The diagnostic codes were grouped into 10 thyroid disorders. For each disorder, an incident case was defined as hospitalization with a case-defining diagnostic code in any diagnostic position or two or more outpatient diagnoses between 1 and 180 days apart, with at least one of these diagnoses in a primary diagnostic position.

Of the 10 thyroid disorder groups, three (acute, subacute and iatrogenic thyroiditis) had fewer than 10 incident cases per year and were dropped from analysis. Only one incident case diagnosis per individual was counted for each of the seven remaining thyroid disorders **(Figure 1a)**. Individuals who met the case definition for a specific thyroid disorder prior to the surveillance period (i.e., prevalent cases) were

FIGURE 1a. Incidence rates of thyroid disorders among females, active component, U.S. Armed Forces, 2002-2011

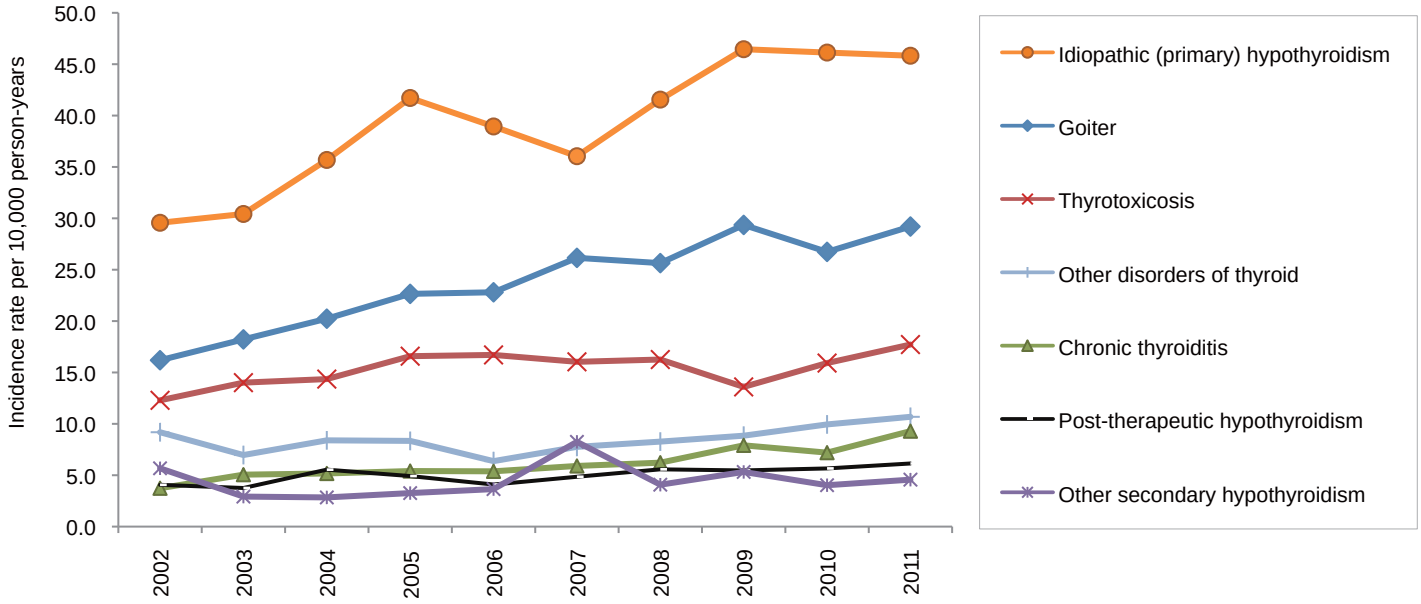
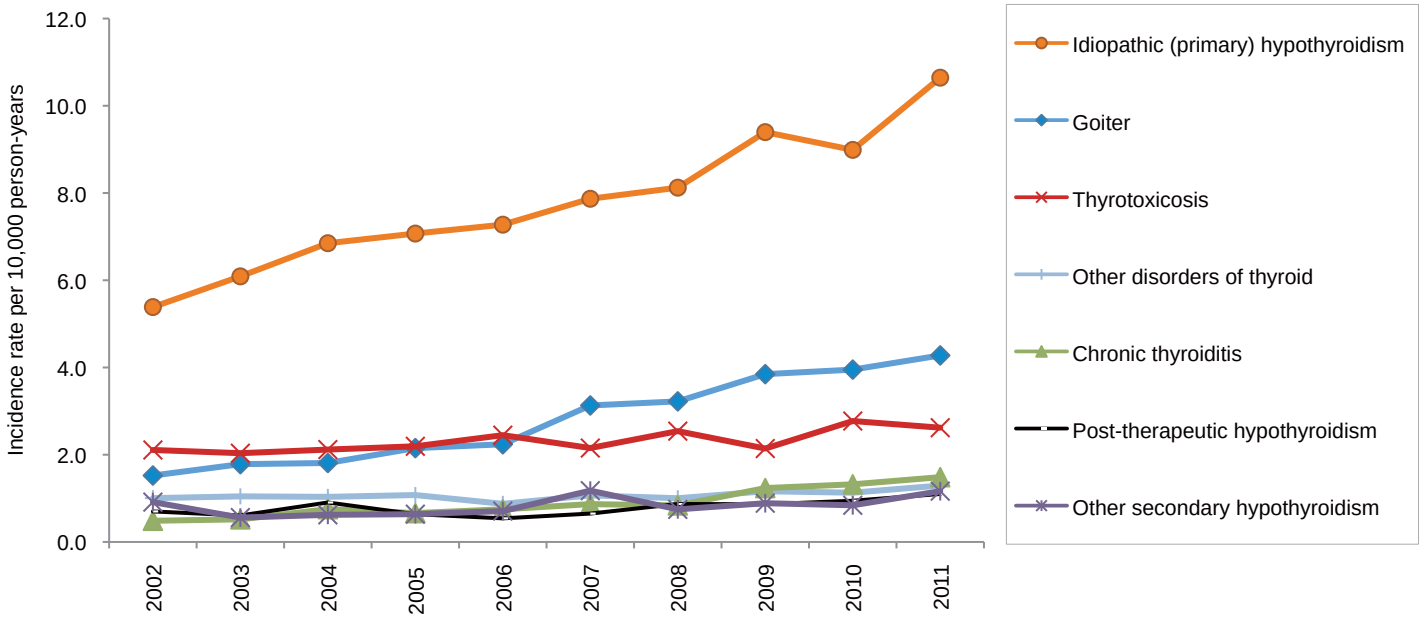


FIGURE 1b. Incidence rates of thyroid disorders among males, active component, U.S. Armed Forces, 2002-2011



excluded from the analysis of that disorder. Among thyroid disorder cases, the numbers of individuals with prior diagnoses of thyroid cancer (ICD-9-CM: 193.x, 237.4) were ascertained. Numbers of screening tests for thyroid disorders (ICD-9-CM: V77.0) recorded on outpatient records of all service members were derived from the Defense Medical Epidemiology Database (DMED).

RESULTS

During 2002-2011, the most common incident thyroid disorders among male and female service members were idiopathic (primary) hypothyroidism, goiter and thyrotoxicosis (hyperthyroidism) **(Figures 1a, 1b)**. Idiopathic hypothyroidism, the most common disorder by far during the period, was diagnosed among 8,006 females (incidence rate: 39.7 per 10,000 person years [p-yrs]) and 9,501 males (incidence rate: 7.8 per 10,000 p-yrs) **(Table 1)**.

Incidence rates of goiter and thyrotoxicosis were much lower than for idiopathic hypothyroidism but sharply higher than for other thyroid disorders. Not surprisingly, most service members with "post-therapeutic hypothyroidism" (n=1,998) had prior

diagnoses of other thyroid disorders (96%) – most often thyrotoxicosis and/or goiter – or thyroid cancer (22%) **(data not shown)**.

Incidence rates of thyroid disorders among females were 5.1 (idiopathic hypothyroidism) to 8.6 (goiter) times the rates of the respective conditions among males **(Table 1)**. Rates of each disorder considered here increased monotonically with age for both genders; rates increased relatively faster with age among males than females. The median ages at the first diagnoses of the thyroid disorders considered here were three to six years higher among males than females **(data not shown)**.

The overall rates of idiopathic hypothyroidism and chronic thyroiditis (e.g., Hashimoto's disease) were at least twice as high among white, non-Hispanic as black, non-Hispanic service members. However, black, non-Hispanic service members had higher rates of goiter, thyrotoxicosis and "other" thyroid disorders than their counterparts **(Table 1)**.

For each of the seven conditions, the annual number of incident diagnoses increased during the period; however, the proportions of incident cases that were hospitalized generally declined **(data not shown)**.

During 10-year period, the rates of incident thyroid disorder diagnoses increased for both genders. Among males, incidence rates of idiopathic hypothyroidism, goiter and chronic thyroiditis (e.g., Hashimoto's disease) more than doubled, while among females the rates of these disorders increased 50 to 150 percent **(Figures 1a,1b)**. Of note, these increases accompany trends of increasing numbers of screening tests for thyroid function that were recorded during outpatient visits during the period **(Figure 2)**.

EDITORIAL COMMENT

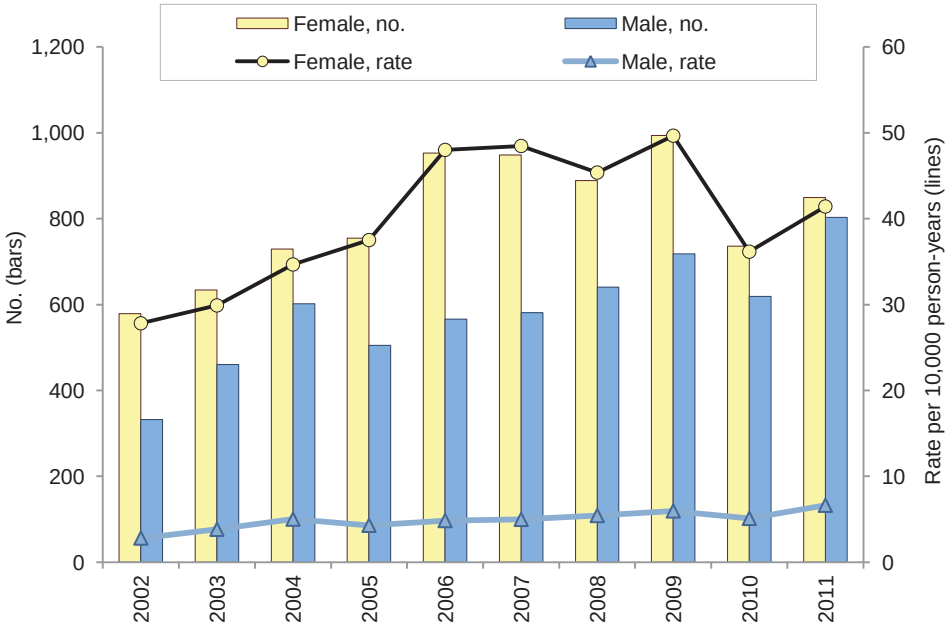
During a recent 10-year period, incidence rates of thyroid disorder diagnoses markedly increased among active component military members, especially males.

TABLE 1. Numbers and rates of incident diagnoses of selected thyroid disorders, by gender, age, and race/ethnicity, active component, U.S. Armed Forces, 2002-2011

	Idiopathic (primary) hypothyroidism			Goiter			Thyrotoxicosis			Other disorders of thyroid			Chronic thyroiditis		
	No.	Rate[a]	IRR[b]	No.	Rate[a]	IRR[b]	No.	Rate[a]	IRR[b]	No.	Rate[a]	IRR[b]	No.	Rate[a]	IRR[b]
All females	8,006	39.7	5.09	4,870	24.1	8.59	3,164	15.7	6.75	1,757	8.7	8.10	1,269	6.3	7.00
All males	9,501	7.8	ref	3,426	2.8	ref	2,832	2.3	ref	1,310	1.1	ref	1,095	0.9	ref
Female age group															
<20	281	16.8	ref	133	7.9	ref	128	7.6	ref	95	5.7	ref	28	1.7	ref
20-24	1,728	23.5	1.40	964	13.1	1.66	845	11.5	1.51	373	5.1	0.89	289	3.9	2.32
25-29	1,746	36.4	2.17	1,085	22.6	2.87	778	16.2	2.14	400	8.3	1.46	259	5.4	3.18
30-34	1,356	50.1	2.98	851	31.4	3.98	529	19.5	2.57	288	10.6	1.87	231	8.5	5.02
35-39	1,328	67.4	4.01	779	39.5	5.00	461	23.4	3.08	306	15.5	2.72	222	11.3	6.62
40+	1,567	91.9	5.47	1,058	62.1	7.86	423	24.8	3.27	295	17.3	3.04	240	14.1	8.28
Female race/ethnicity															
White, non-Hispanic	5,160	51.8	ref	2,328	23.4	ref	1,263	12.7	ref	841	8.4	ref	817	8.2	ref
Black, non-Hispanic	1,370	24.5	0.47	1,740	31.1	1.33	1,205	21.5	1.70	613	11.0	1.30	190	3.4	0.41
Other	1,476	31.9	0.61	802	17.3	0.74	696	15.0	1.18	303	6.5	0.78	262	5.7	0.69
Male age group															
<20	189	2.3	ref	29	0.3	ref	74	0.9	ref	39	0.5	ref	20	0.2	ref
20-24	1,339	3.3	1.44	394	1.0	3.25	556	1.4	1.53	197	0.5	0.97	138	0.3	1.71
25-29	1,558	5.8	2.52	520	1.9	6.46	587	2.2	2.43	233	0.9	1.74	198	0.7	3.69
30-34	1,544	8.6	3.76	512	2.9	9.56	473	2.6	2.94	229	1.3	2.57	175	1.0	4.90
35-39	1,975	12.8	5.59	712	4.6	15.44	538	3.5	3.89	263	1.7	3.42	250	1.6	8.13
40+	2,896	22.0	9.57	1,259	9.6	31.89	604	4.6	5.10	349	2.7	5.30	314	2.4	11.93
Male race/ethnicity															
White, non-Hispanic	7,152	9.0	ref	2,323	2.9	ref	1,534	1.9	ref	841	1.1	ref	826	1.0	ref
Black, non-Hispanic	748	4.1	0.45	551	3.0	1.03	651	3.5	1.86	214	1.2	1.06	67	0.4	0.36
Other	1,601	6.6	0.73	552	2.3	0.79	647	2.7	1.41	255	1.1	0.96	202	0.8	0.83

[a]Rate per 10,000 person-years of military service
[b]IRR Incidence rate ratio

FIGURE 2. Numbers and rates of ICD-9-CM health status code V77.0 "special screening for thyroid disorders," by gender, active component, U.S. Armed Forces, 2002-2011



The finding may be due, at least in part, to increased testing for thyroid function disorders among military members over the same period. Population-based surveys have estimated that 4-5 percent of females and 1-3 percent of males have "subclinical hypothyroidism" characterized by elevated TSH levels but few or no overt symptoms of thyroid underactivity.[7] Routine screening for thyroid dysfunction is not recommended for asymptomatic adults.[7,8] However, increased thyroid function testing of military members since the beginning of the wars in Iraq and Afghanistan may reflect increased testing of military members with mental disorders (e.g., depression, irritability, PTSD), musculoskeletal pain, sleep disorders, menstrual/fertility abnormalities, obesity, and other conditions which have sharply increased in prevalence over the same period.

The findings of this report should be interpreted with consideration of its limitations. For example, the report documents incidence rates of thyroid disorders based on diagnoses recorded on standardized medical records. As such, the findings reflect rates at which thyroid functional abnormalities were clinically detected – not prevalences of thyroid dysfunction among military members overall (because not all members of the population were tested). Still, despite its limitations, this report provides useful information regarding the burden of thyroid disorders on the Military Health System.

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Reported Vectorborne and Zoonotic Diseases, U.S. Air Force, 2000-2011

Madeline M. Anna, BS; James D. Escobar, MPH; Alice S. Chapman, DVM, MPH (Col, U.S. Air Force)

During 2000-2011, U.S. Air Force Public Health Officers reported 770 cases of vectorborne and zoonotic diseases diagnosed at Air Force medical treatment facilities. Cases of Lyme disease accounted for 70 percent (n=538) of all cases and most cases of Lyme disease (57%) were reported from bases in the northeastern U.S. and in Germany. The annual numbers of reported Lyme disease cases were much higher during the last four years than earlier in the surveillance period. The next most commonly reported events were malaria (74 cases), Rocky Mountain spotted fever (RMSF) (41), Q fever (33), dengue (23), and leishmaniasis (20). These five infections and Lyme disease accounted for 95 percent of the reported conditions. Military service members accounted for a majority of the reported cases for most of the conditions, but family members and retirees accounted for most of the cases of Lyme disease and RMSF. Most reports of vectorborne and zoonotic diseases did not include mentions of recent travel.

U.S. Air Force members are exposed to potential disease vectors where they live, train, and deploy throughout the world. Similarly, military family members living and traveling in endemic areas are also at risk for vectorborne diseases. Arthropods including mosquitoes, ticks, mites, and sand flies make up the greatest proportion of vectors that transmit diseases of military significance.[1] Zoonotic diseases transmitted from animals to humans are less frequently reported in military settings but also have the potential to cause severe illness or death. Air Force Public Health personnel at each base monitor the occurrence of vectorborne and zoonotic diseases specified in the *Armed Forces* (formerly *Tri-Service*) *Reportable Events Guidelines & Case Definitions* and submit electronic reports of incident cases through the Air Force Reportable Events Surveillance System (AFRESS) to the Epidemiology Consult Service at the U.S. Air Force School of Aerospace Medicine.[2]

Historically, the Epidemiology Consult Service has compiled summaries of the annual incidence rates for certain reportable events (e.g., sexually transmitted and gastrointestinal infections). These rates are tabulated and analyzed according to major command and installation and are available to those with access to the Epidemiology Consult Service website. This report summarizes information on the incidence of the vectorborne and zoonotic diseases most frequently reported through AFRESS, and the demographic characteristics, travel patterns, and geographic distribution of cases. Opportunities for prevention and control are discussed in light of these findings.

METHODS

The surveillance period was 1 January 2000 through 31 December 2011. AFRESS was queried for reported events with ICD-9 codes corresponding to anthrax, brucellosis, arboviral encephalitis, dengue, ehrlichiosis/anaplasmosis, filariasis, hantavirus, hemorrhagic fever, leishmaniasis (all types), leprosy, leptospirosis, Lyme disease, malaria (all types), plague, Q fever, relapsing fever, Rift Valley fever, Rocky Mountain spotted fever (RMSF), trypanosomiasis, tularemia, and typhus. The population of interest consisted of recipients of health care at Air Force medical treatment facilities (MTFs) during the surveillance period. Beneficiaries of such care were grouped into four categories: military members (including active and reserve component members), retired service members, dependents (i.e., family members), and others. By using dates of onset and information in the comment fields of AFRESS reports, duplicate records were removed, as were cases for which a vectorborne or zoonotic disease was ultimately ruled out. Relevant travel histories (as reported through AFRESS) were defined by exposures to locations within 60 days preceding disease onsets; up to three locations could be considered potentially relevant exposures for each reported case. For surveillance purposes, countries were grouped by major command. Data were analyzed using SAS 9.2 (SAS Institute Inc., Cary, NC).

RESULTS

During the 12-year surveillance period, 770 cases of vectorborne and zoonotic disease were reported among beneficiaries receiving care at Air Force medical treatment facilities. Ten bases accounted for more than half (51.4%) of all case events: McGuire AFB, NJ (100); Ramstein AB, Germany (91); Andrews AFB, MD (47); Spangdahlem AB, Germany (35); Hanscom AFB, MA (29); Dover AFB, DE (25); Scott AFB, IL (20); Tinker AFB, OK (17); Bolling AFB, DC; and MacDill AFB, FL (16 cases each). Nearly half (357, 46%) of the cases had their onsets during the months of June, July, or August. In total, 725 (94%) of the reported cases were recorded in AFRESS as having been confirmed in accordance with the *Tri-Service Reportable Events Guidelines* in effect at the time of disease onset. The most common confirmation methods were serology and clinical diagnosis, accounting for 561 confirmed cases (77%). Other categories of confirmation included culture (59); blood smear (30); or biopsy (18). The method of confirmation was not stated for 57 cases. **Table 1** summarizes the demographic characteristics of all reported cases.

Lyme disease accounted for 70 percent (n=538 cases) of all reported vectorborne or zoonotic diseases during the period. There were more cases of Lyme disease

TABLE 1. Reported cases of vectorborne or zoonotic diseases, by military and demographic characteristics, Air Force Reportable Events Surveillance System, 2000-2011

	No.	%
Age group		
<1-17	164	21.3
18-24	99	12.9
25-34	189	24.5
35-44	176	22.9
45-64	124	16.1
65+	18	2.3
Sex		
Male	443	57.6
Female	296	38.4
Not reported	31	4.0
Beneficiary status		
Military	390	50.6
Dependent	303	39.4
Retiree	65	8.4
Other	12	1.6
Service branch		
Air Force	628	81.7
Army	86	11.2
Navy	29	3.8
Marine Corps	12	1.6
Other[a]	15	1.9

[a]1 unknown, 1 Coast Guard and 13 civilians (non-service affiliated)

FIGURE 1. Cases of vectorborne and zoonotic diseases reported through the Air Force Reportable Events Surveillance System (AFRESS), 2000-2011

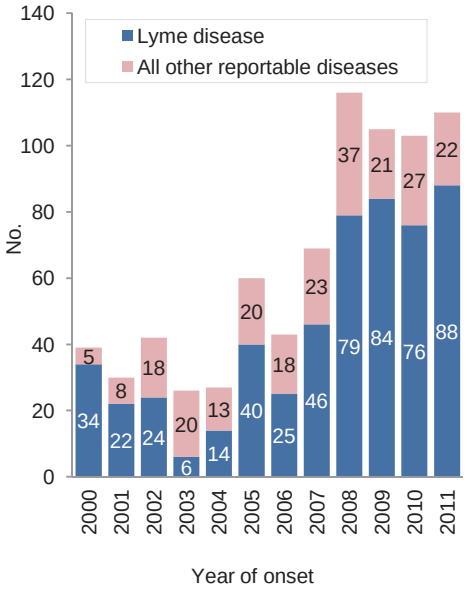

TABLE 2. Cases of vectorborne and zoonotic diseases reported by Air Force medical treatment facilities, by beneficiary category, 2000-2011

	All	Military		Dependent		Retiree		Other	
	No.	No.	%	No.	%	No.	%	No.	%
Lyme disease	538	232	43	257	48	46	9	3	1
Malaria	74	66	89	4	5	1	1	3	4
RMSF	41	16	39	19	46	6	15	.	.
Q fever	33	21	64	6	18	3	9	3	9
Dengue	23	16	70	4	17	3	13	.	.
Leishmaniasis	20	18	90	.	.	1	5	1	5
Brucellosis	7	3	43	1	14	1	14	2	29
Erlichiosis/anaplasmosis	7	5	71	2	29	.	.	.	.
Encephalitis, arboviral/ tickborne	6	3	50	2	33	1	17	.	.
Leprosy	6	2	33	3	50	1	17	.	.
Hantavirus	4	2	50	1	25	1	25	.	.
Leptospirosis	3	2	67	1	33	.	.	.	.
Tularemia	3	2	67	1	33	.	.	.	.
Relapsing fever	2	1	50	.	.	1	50	.	.
Trypanosomiasis	2	1	50	1	50	.	.	.	.
Plague	1	.	.	1	100	.	.	.	.
Total	770	390	.	303	.	65	.	12	.

among family members (257 cases, 48%) than military members (232 cases, 43%). Most (284, 53%) Lyme disease cases were confirmed by serology; 133 (25%) were diagnosed clinically. Bases in the northeastern U.S. (McGuire, Andrews, Hanscom, and Dover) and Germany (Ramstein and Spangdahlem) accounted for 57 percent of the reported cases of Lyme disease. Lyme disease reports sharply increased from 2006 (n=25) through 2008 (n=79); there were many more cases each year from 2008-2011 than during any previous year of the period **(Figure 1)**.

The next most commonly reported events were malaria (74 cases), RMSF (41), Q fever (33), dengue (23), and leishmaniasis (20). Together with Lyme disease, these accounted for 95 percent of all reported cases of vectorborne and zoonotic diseases. In contrast to Lyme disease and RMSF, cases of malaria, Q fever, dengue, and leishmaniasis were reported predominantly among active military members (121 of 150 total reports of these four conditions). **Table 2** summarizes the military health care beneficiary statuses of all individuals affected by vectorborne and zoonotic diseases (as reported through AFRESS) during the surveillance period.

Travel or deployments within 60 days preceding disease onsets were documented in AFRESS for 238 (31%) of all the reportable events addressed in this report. Cases reported travel to 70 different countries, and 48 (20%) of recently traveled cases visited two or more countries. Of note, 91 percent of reported travel among Lyme disease cases was to the U.S. European Command (EUCOM) region, predominantly Germany, and to the U.S. Northern Command (NORTHCOM), primarily the northeastern U.S. For the majority of cases (532, 69%), no travel beyond the local residence area was recorded. **Table 3** summarizes the locations of travel by geographic command reported by patients diagnosed with vectorborne and zoonotic diseases.

EDITORIAL COMMENT

This report summarizes cases of vectorborne and zoonotic diseases (reported through the AFRESS) among Department of Defense (DoD) beneficiaries who received

TABLE 3. Cases of vectorborne and zoonotic diseases and number of trips to combatant command (COCOM) locations reported by cases, Air Force Reportable Events Surveillance System, 2000-2011

	Total	No travel reported		Any travel reported[a]		Northern Command		Southern Command		Africa Command		European Command		Central Command		Pacific Command	
	No. of cases	No. of cases	%	No. of cases	%	No. of trips[c]	%	No. of trips[c]	%	No. of trips[c]	%	No. of trips[c]	%	No. of trips[c]	%.	No. of trips[c]	%
Lyme disease	538	429	79.7	109	20.3	40	27.7	1	0.7	1	0.7	91	63.2	5	3.5	6	4.2
Malaria	74	16	21.6	58	78.4	4	5.3	12	16.0	29	38.7	3	4.0	21	28.0	6	8.0
RMSF	41	37	90.2	4	9.8	4	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Q fever	33	15	45.5	18	54.5	1	6.0	1	5.0	3	15.0	0	0.0	15	75.0	0	0.0
Dengue	23	3	13.0	20	87.0	4	15.4	4	15.4	2	7.7	1	3.8	0	0.0	15	57.7
Leishmaniasis	20	1	5.0	19	95.0	0	0.0	0	0.0	0	0.0	1	4.0	23	92.0	1	4.0
All others[b]	41	31	75.6	10	24.4	6	60.0	2	20.0	0	0.0	0	0.0	1	10.0	1	10.0
Total	770	532		238		59		20		35		96		65		29	

[a]Travel or deployment within 60 days prior to disease onset documented in AFRESS
[b]Brucellosis, erlichiosis/anaplasmosis, encephalitis (arborviral/tickborne), leprosy, hantavirus, leptospirosis, tularemia, relapsing fever, trypanosomiasis, and plague
[c]Travel or deployment reported by cases. Because cases could report up to three travel locations, total number of trips may exceed the number of cases.

care at Air Force medical treatment facilities from 2000-2011. Lyme disease cases constituted the largest proportion of overall reportable events. The predominance of reporting from bases located in the northeastern U.S. and Germany coincides with the regions where Lyme disease is known to be endemic.[3-6] Only a small proportion of Lyme disease cases included any documentation of travel away from the home station area, suggesting that the majority of the illnesses were acquired locally. In contrast, diseases not endemic to the U.S. and Europe, such as malaria, leishmaniasis, and dengue, occurred much more frequently among active military members than family members or other health care beneficiaries and were most often associated with foreign travel.

Most of the reports of vectorborne and zoonotic diseases did not include mentions of recent travel. Whether such reports accurately depict recent travel as a risk factor or reflect a limitation in obtaining comprehensive travel histories is uncertain. However, unreported travel is less likely to be a factor in Lyme disease cases, most of which were reported from highly endemic areas. Reports of travel were more commonly reported among cases of malaria, leishmaniasis, dengue, and Q fever.

Between 2000 and 2007, vectorborne and zoonotic diseases were reported in relatively low numbers and varied considerably from year to year. The observed reporting pattern is not due to changes in clinical and laboratory criteria for reporting these conditions; the criteria were unchanged between 1998 and 2004, when *Tri-Service Reportable Events Guidelines* were updated.[7,8] More likely, the pattern reflects medical treatment facility-specific surveillance procedures that tended to focus on more frequently occurring events such as sexually-transmitted and gastrointestinal illnesses. The increase in reported incidence since 2008 is likely due to several factors. The increase in vectorborne and zoonotic diseases other than Lyme disease (i.e., malaria, leishmaniasis, dengue, and Q fever) coincides with increased U.S. military deployments to the CENTCOM and AFRICOM areas of responsibility where these diseases are prevalent. Increased reporting of Lyme disease among DoD beneficiaries parallels a similar trend in Lyme disease incidence reported by the Centers for Disease Control and Prevention for the same period.[4] Public health education campaigns such as those initiated by the Centers for Disease Control and Prevention have resulted in increased awareness by the public, who may be more likely to report tick bites, and by physicians, who are more apt to recognize clinical signs and to test for Lyme disease.

The findings of this report have implications for prevention and control of vectorborne and zoonotic diseases among DoD beneficiaries. Historically, the military's efforts to control vectorborne diseases have focused on the use of permethrin-treated uniforms, DEET-containing insect repellent on exposed skin, proper uniform wear, and where indicated, prophylactic medications. These measures have been in use from World War II through the recent conflicts in Iraq and Afghanistan to reduce the impacts of arthropod-borne diseases on military operations. Despite the availability of highly effective countermeasures, however, vectorborne diseases continue to reduce military operational capabilities.[9]

The diverse reservoirs and modes of transmission associated with the zoonoses of interest for this report suggest the need for a variety of prevention tools and strategies. It is notable that 59 percent of the vectorborne and zoonotic illnesses reported among military members and 81 percent of such illnesses among other military health care beneficiaries were due to Lyme disease, the majority of which occurred at or near home station. While some of these events among military members may have been related to military training conducted outdoors in tick-infested areas, it is likely that many were the result of exposures during off-duty pursuits (e.g., hiking, camping, and gardening).

The findings of this report underscore the need for increased education and

prevention efforts aimed at military members as well as family members and retirees; such efforts should be tailored to recreational activities that increase risk of exposures to known vectors of zoonotic infectious diseases. For example, some of the zoonotic diseases reported here may have involved contact with animals (domestic and wild) during on and off-duty activities; participants in such activities should be reminded to avoid contact with animal body fluids/feces. Targeted public health messages, aimed at the right audiences with the right content at the right time, may prove more effective in reducing the risk of vectorborne and zoonotic diseases than one-size-fits-all approaches.

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Brief Report

Reported Vectorborne and Zoonotic Diseases, U.S. Army and U.S. Navy, 2000-2011

Since 1998, in the U.S. Armed Forces, medical events of public health and/or military importance have been reported through service-specific electronic reporting systems. These systems are currently known as the Air Force Reportable Events Surveillance System (AFRESS), the Navy Disease Reporting System internet (NDRSi) and the Army Disease Reporting System (DRSi). Data from these systems are routinely provided to the Armed Forces Health Surveillance Center (AFHSC) and incorporated into the Defense Medical Surveillance System (DMSS).[1]

In this issue of the *MSMR*, Anna and colleagues report counts, rates, and trends of vectorborne and zoonotic diseases diagnosed at Air Force medical treatment facilities and reported through the Air Force Reportable Events Surveillance System between 2000 and 2011.[2] This report provides summary data for vectorborne and zoonotic diseases reported through the Army and Navy systems.

METHODS

The surveillance period was 1 January 2000 through 31 December 2011. The surveillance population included any beneficiary of the military health care system who received care at a U.S. Army or Navy military treatment facility during the surveillance period; this included active and reserve component service members, dependents, and retirees. For surveillance purposes, a case of a vectorborne or zoonotic reportable event was defined as any reportable medical event reported through a system other than AFRESS with an ICD-9 code of interest. Beneficiary status was grouped into four categories: 1) military: active and reserve component members; 2) dependent: spouses and children of active or retired military members; 3) retirees: retired members of the U.S. Armed Forces; 4) other: U.S. civilian employees, foreign nationals, etc.

RESULTS

During the 12-year surveillance period, 4,534 cases of vectorborne and zoonotic disease were reported among beneficiaries receiving care at Army and Navy medical treatment facilities. A majority of cases occurred in males (80.9%), military members (70.5%), and the Army (53.1%) **(Table 1)**. Over one-half (54.9%) of cases occurred in individuals aged 18-34; nearly one-quarter (23.1%) occurred in individuals aged <1 to 17 **(Table 1)**.

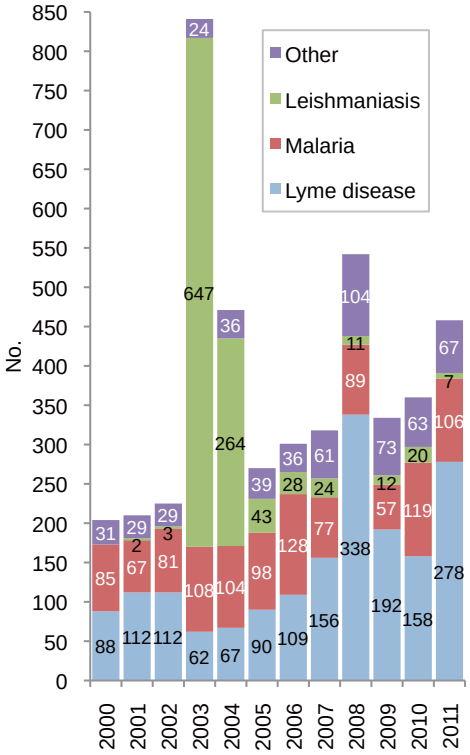
Lyme disease accounted for 39 percent (n=1,762 cases) of all reported vectorborne or zoonotic diseases during the period **(Table 2)**. Malaria and leishmaniasis each accounted for nearly a quarter of all cases (malaria: 25%; n=1,119; leishmaniasis: 23%, n=1,061). Unlike Lyme disease, cases of malaria and leishmaniasis were far more likely to be reported in military members than other beneficiaries (86.1% and 97.3%, respectively).

The next most commonly reported events were Q fever (n=159; 4%), Rocky Mountain Spotted Fever (RMSF) (n=122; 3%), and dengue (n=113; 2%). Q fever was much more commonly reported in service members (85.5%) compared to RMSF (58.2%) and dengue (59.3%) which were often reported among members of the other beneficiary categories. The remaining 4 percent of reported cases are summarized in **Table 2.**

TABLE 1. Reported cases of vectorborne or zoonotic diseases, by military and demographic characteristics, non-AFRESS, 2000-2011

	No.	%
Age group		
<1-17	1,046	23.1
18-24	1,253	27.6
25-34	1,237	27.3
35-44	678	15.0
45-64	290	6.4
65+	30	0.7
Sex		
Male	3,669	80.9
Female	861	19.0
Not reported	4	0.1
Beneficiary status		
Military	3,198	70.5
Dependent	760	16.8
Retiree	549	12.1
Other	27	0.6
Service branch		
Air Force	383	8.5
Army	2,409	53.1
Navy	236	5.2
Marine Corps	225	5.0
Other	1,281	28.3

FIGURE 1. Cases of vectorborne and zoonotic diseases reported by Army and Navy treatment facilities, 2000-2011



During the 12-year surveillance period counts of Lyme disease remained relatively stable from 2000 to 2004 then increased from 2005 to 2008 **(Figure 1)**. Counts of Lyme disease more than doubled from 2007 (n=156) to 2008 (n=338). From 2009 to 2011, counts of Lyme disease were lower than 2008, but remained higher than earlier years. Counts of malaria remained relatively stable throughout the period (range: n=67 [2001] to n=128 [2006]). Counts of leishmaniasis peaked dramatically in 2003 (n=647); this year alone accounted for 61 percent of all leishmaniasis cases and 14 percent of all vectorborne and zoonotic cases overall during the period. After 2003 the numbers of cases of leishmaniasis fell dramatically to a low of seven cases in 2011. Counts of all other vectorborne and zoonotic cases were relatively low; however, the case count of these other diseases reached a high of 104 in 2008 **(Figure 1)**. This peak is reflective of an increase of Q fever cases (n=48); 30 percent of all Q fever cases occurred in 2008 **(data not shown)**.

TABLE 2. Cases of vectorborne and zoonotic diseases reported by Army and Navy medical treatment facilities, by beneficiary category, 2000-2011

	All	Military		Dependent		Retiree		Other	
	No.	No.	%	No.	%	No.	%	No.	%
Total	4,534	3,198	70.5	760	16.8	549	12.1	27	0.6
Lyme disease	1,762	803	45.6	640	36.3	316	17.9	3	0.2
Malaria	1,119	963	86.1	36	3.2	103	9.2	17	1.5
Leishmaniasis	1,061	1,032	97.3	3	0.3	24	2.3	2	0.2
Q fever	159	136	85.5	8	5.0	15	9.4	0	0.0
RMSF	122	71	58.2	25	20.5	26	21.3	0	0.0
Dengue	113	67	59.3	21	18.6	22	19.5	3	2.7
Ehrlichiosis/anaplasmosis	49	29	59.2	8	16.3	12	24.5	0	0.0
Leptospirosis	38	27	71.1	5	13.2	5	13.2	1	2.6
Encephalitis, arboviral/ tickborne	26	12	46.2	6	23.1	8	30.8	0	0.0
Hantavirus	25	16	64.0	3	12.0	5	20.0	1	4.0
Brucellosis	22	14	63.6	2	9.1	6	27.3	0	0.0
Leprosy	17	14	82.4	2	11.8	1	5.9	0	0.0
Tularemia	11	7	63.6	1	9.1	3	27.3	0	0.0
Relapsing fever	5	4	80.0	0	0.0	1	20.0	0	0.0
Other	3	2	66.7	0	0.0	1	33.3	0	0.0
Plague	1	0	0.0	0	0.0	1	100.0	0	0.0
Trypanosomiasis	1	1	100.0	0	0.0	0	0.0	0	0.0

EDITORIAL COMMENT

This report summarizes cases of vectorborne and zoonotic diseases reported by Army and Navy treatment facilities (non-AFRESS) from 2000 to 2011. Compared to the AFRESS results reported on pages 11-14 of this *MSMR*, there were nearly four times the number of cases reported from the Army and Navy systems. In addition, a greater proportion of cases reported by the Army and Navy were military service members (70.5% compared to 50.6% in AFRESS). Despite these differences, the distribution of the cases across all beneficiary categories was similar for the most commonly reported diseases (i.e., Lyme disease and malaria).

In both reports, Lyme disease was the most commonly reported disease and around 40 to 45 percent of cases occurred in service members. Malaria was the second most common disease reported here and from AFRESS; in all three services the vast majority of cases occurred in military service members (86-89%). Unlike the pattern of cases reported to AFRESS, leishmaniasis cases were the third most common disease reported from the Army and Navy systems. The peak of 647 cases in 2003 corresponds with an outbreak of leishmaniasis among U.S. forces deployed to Iraq; the subsequent dramatic decrease was likely a result of housing improvements at installations in Iraq and Afghanistan, control of the disease vector, and increased emphasis on personal protective measures.[3]

Similar to the AFRESS report, this report highlights the ongoing threat of vectorborne and zoonotic diseases among military members and other beneficiaries of the Military Health System. The overall profile of diseases is more diverse for military members than other beneficiaries because of greater risk of exposure to disease vectors or reservoirs during training exercises and deployment to endemic areas outside of the U.S. (where leishmaniasis, malaria, and Q fever are endemic). However, Lyme disease is endemic to the U.S. and is the single most common vectorborne or zoonotic disease among all beneficiary types together. Efforts to minimize exposure to disease vectors (e.g., ticks, mosquitoes, sand flies) through use of personal protective measures (e.g., insect repellant, long sleeves and pants) should be emphasized to every beneficiary of the Military Health System.

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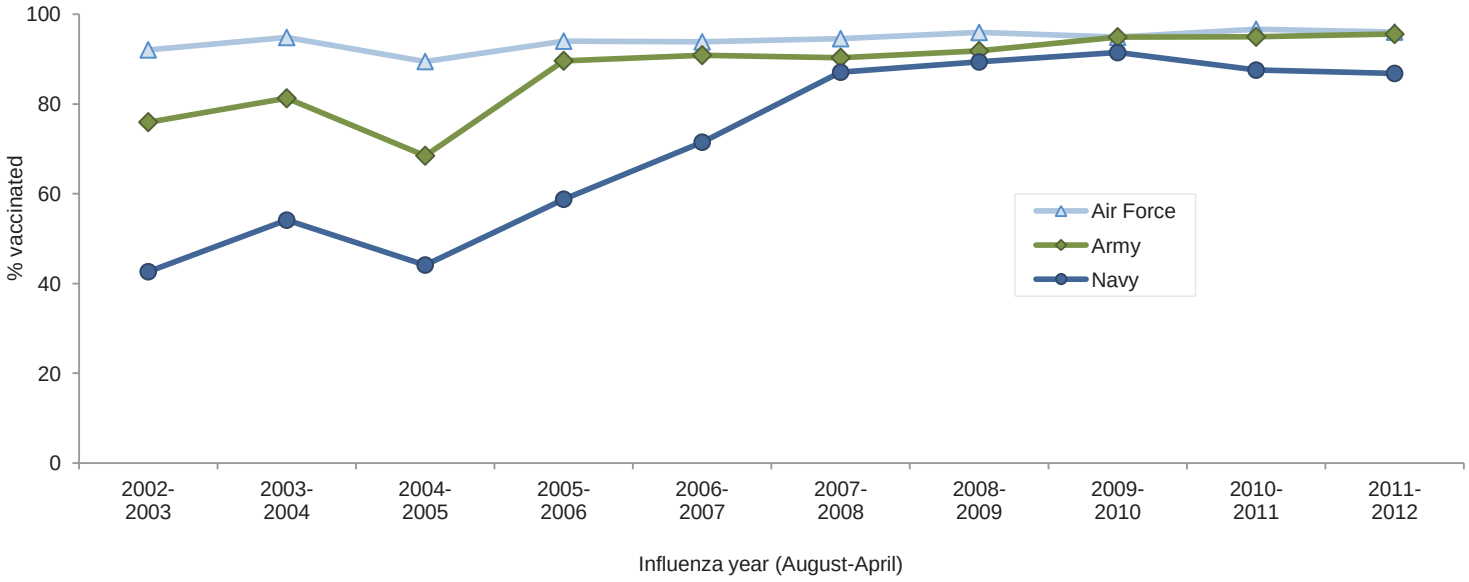
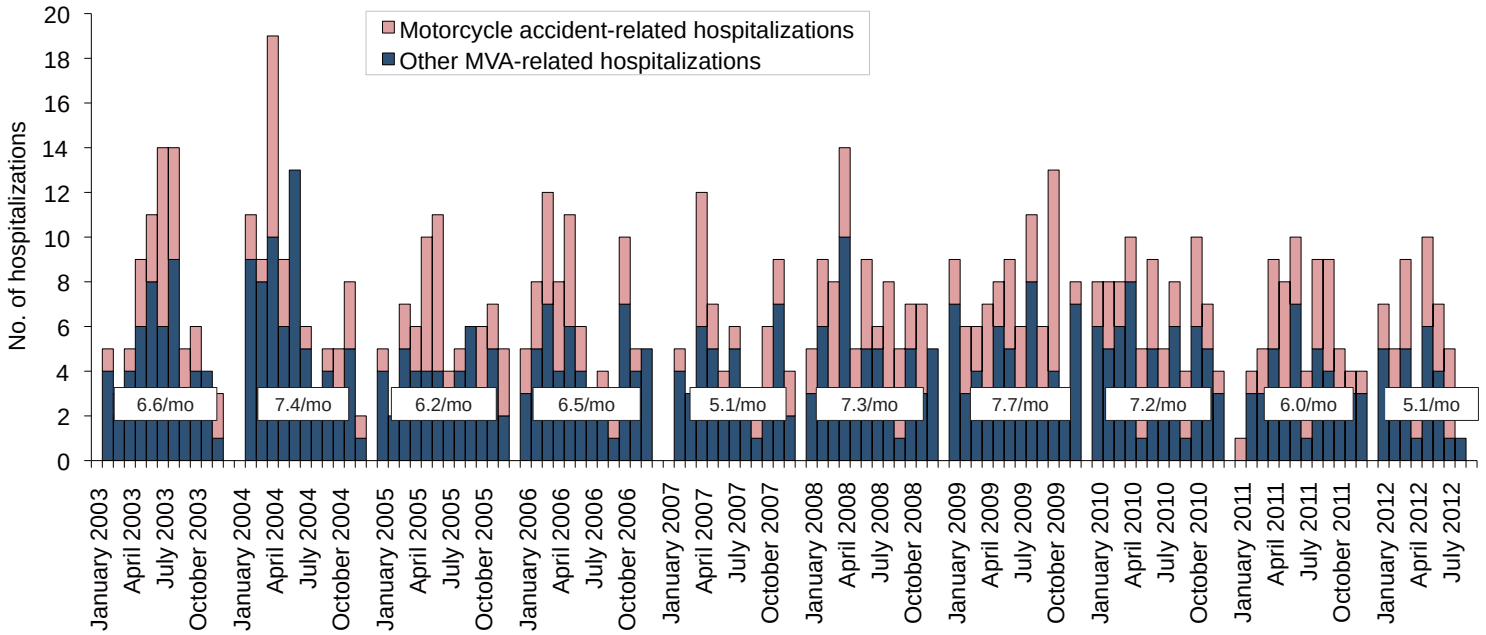
Surveillance Snapshot: Influenza Immunization Among Health Care Workers, August 2002-April 2012

Percentage of health care specialists and officers (excluding veterinary) with records of influenza vaccination from 1 August to 30 April, by year and military service, active component, U.S. Armed Forces, August 2002-April 2012



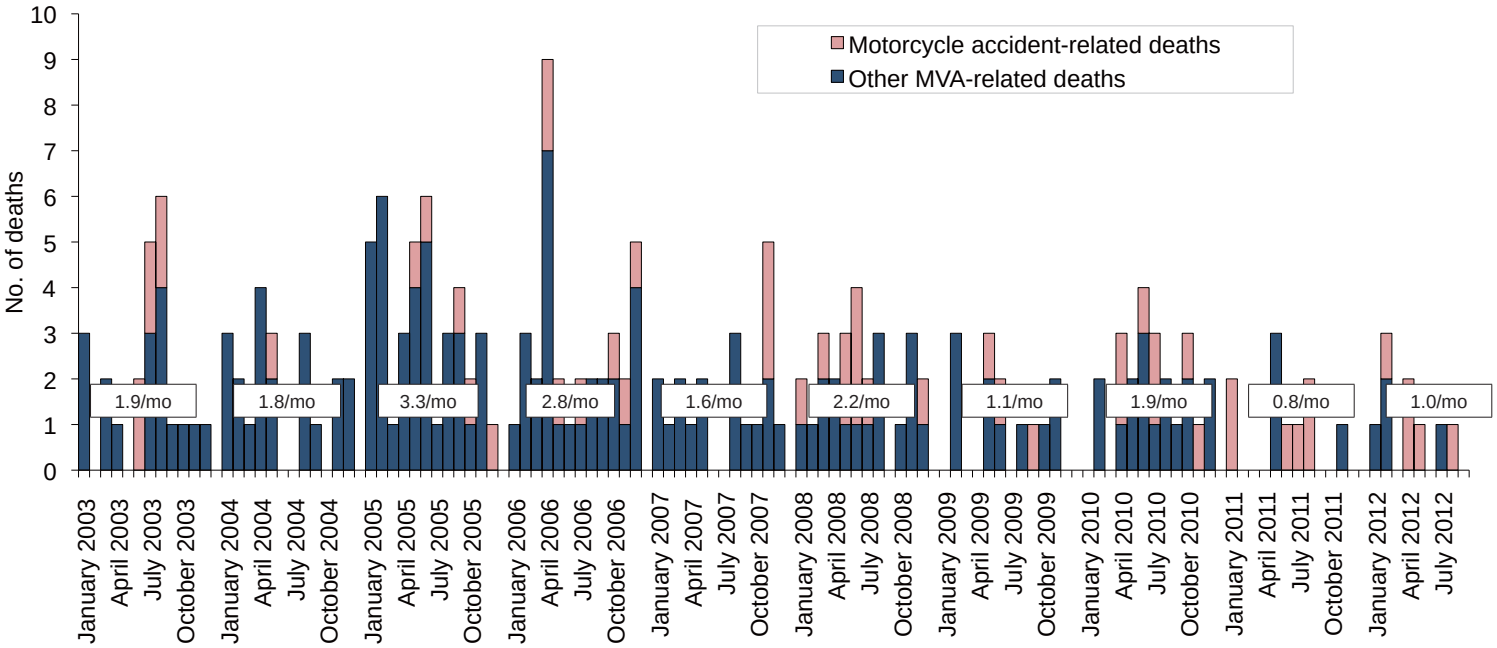
Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-September 2012 (data as of 24 October 2012)

Hospitalizations outside of the operational theater for motor vehicle accidents occurring in non-military vehicles (ICD-9-CM: E810-E825; NATO Standard Agreement 2050 (STANAG): 100-106, 107-109, 120-126, 127-129)



Note: Hospitalization (one per individual) while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days of another motor vehicle accident-related hospitalization.

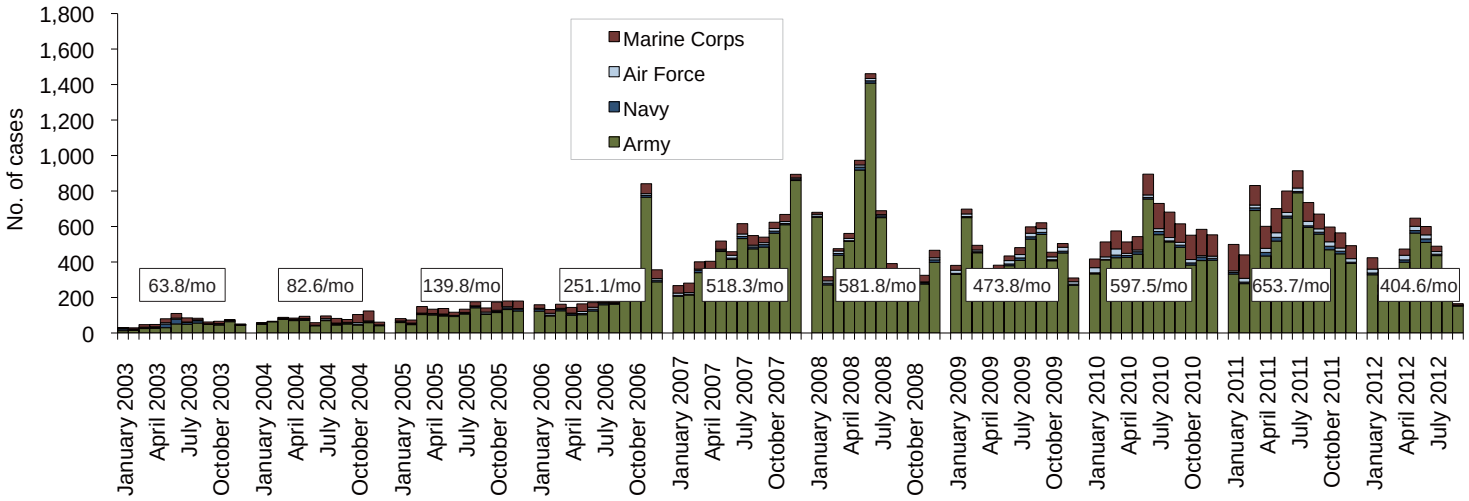
Deaths following motor vehicle accidents occurring in non-military vehicles and outside of the operational theater (per the DoD Medical Mortality Registry)



Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. Medical Surveillance Monthly Report (MSMR). Mar 11;17(3):2-6.
Note: Death while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days prior to death.

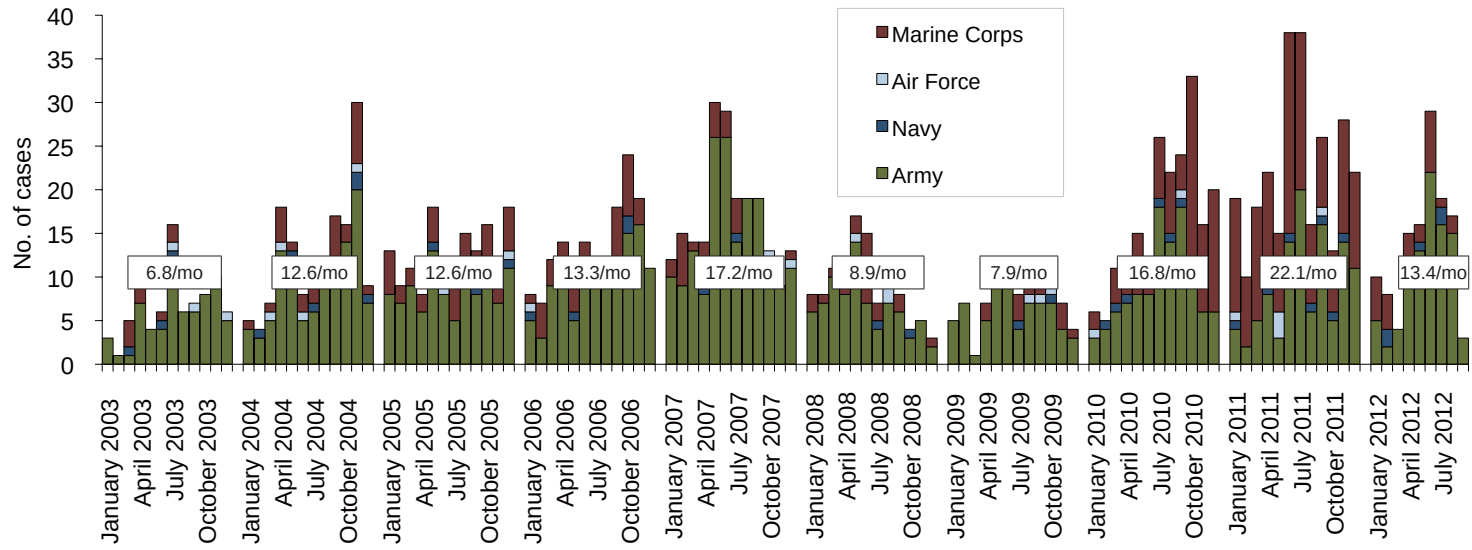
Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-September 2012 (data as of 24 October 2012)

Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]



Reference: Armed Forces Health Surveillance Center. Deriving case counts from medical encounter data: considerations when interpreting health surveillance reports. *MSMR*. Dec 2009; 16(12):2-8.
[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 3,084 deployers who had at least one TBI-related medical encounter any time prior to OEF/OIF).

Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990-2004. *MSMR*. Jan 2005;11(1):2-6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF/OND.

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